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Jung et al.

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(54) **LIQUID CRYSTAL DISPLAY DEVICE**

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(30) **Foreign Application Priority Data**

Nov. 23, 2022 (KR) 10-2022-0158675

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G02F 1/13357 (2006.01)

(52) **U.S. Cl.**
CPC .. ***G02F 1/133605*** (2013.01); ***G02F 1/133603*** (2013.01)

(58) **Field of Classification Search**
CPC G02F 1/133605; G02F 1/133603
USPC 349/61–68
See application file for complete search history.

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(57) **ABSTRACT**

A liquid crystal display device includes a bottom cover; a backlight unit disposed over the bottom cover and including a light source and a reflector sheet; and a liquid crystal panel disposed over the backlight unit, wherein the reflector sheet includes first and second sheet portions adjacent to each other in a first direction and at least one first reflective tape fixing the first and second sheet portions, and wherein the at least one first reflective tape includes a plurality of cutouts extending in a second direction perpendicular to the first direction.

11 Claims, 10 Drawing Sheets

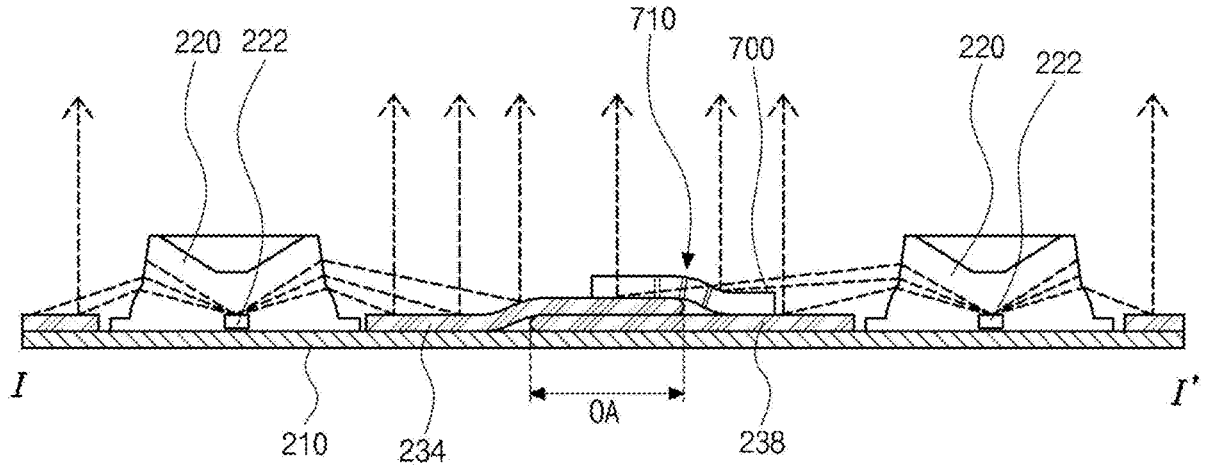


FIG. 1

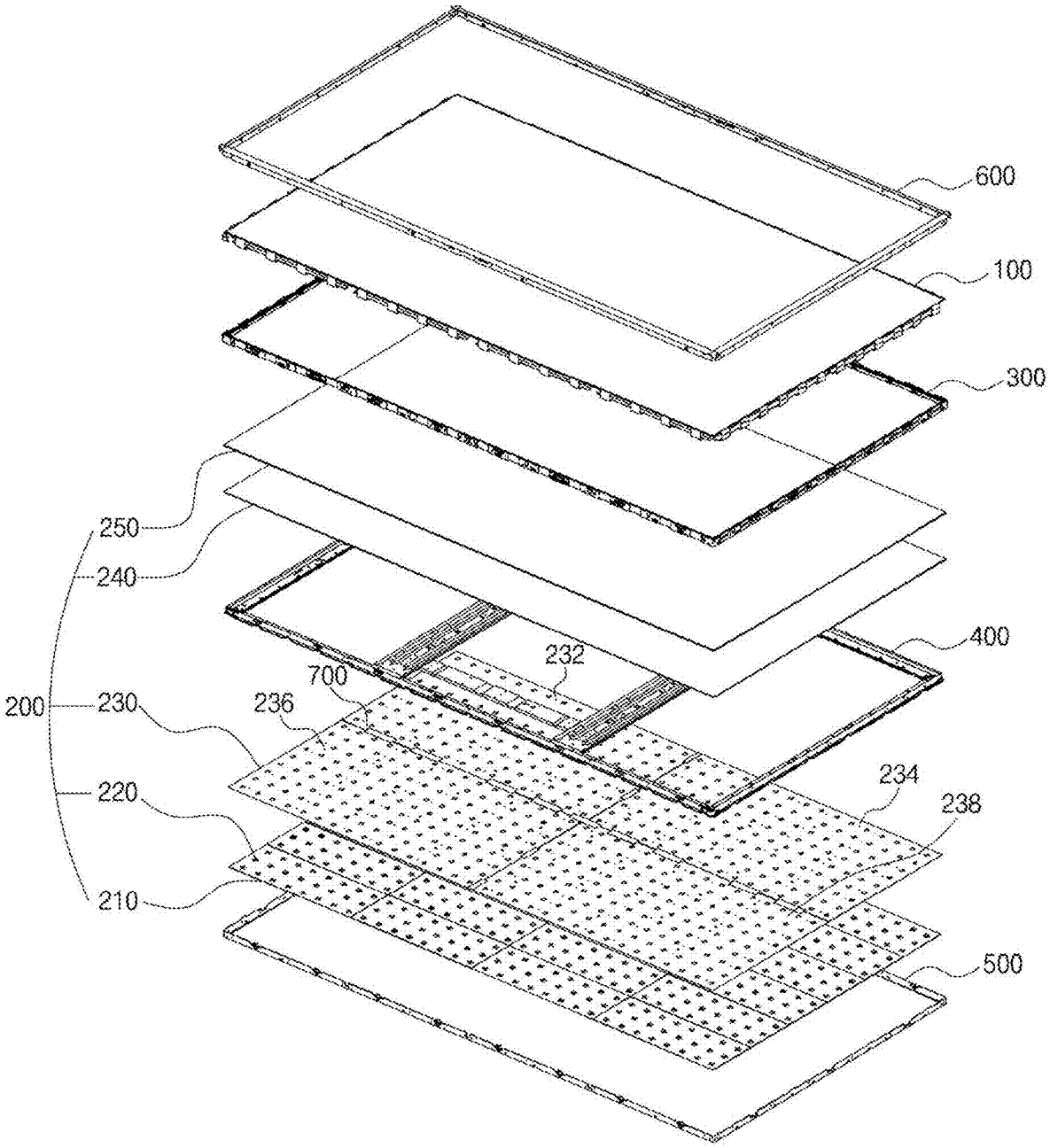
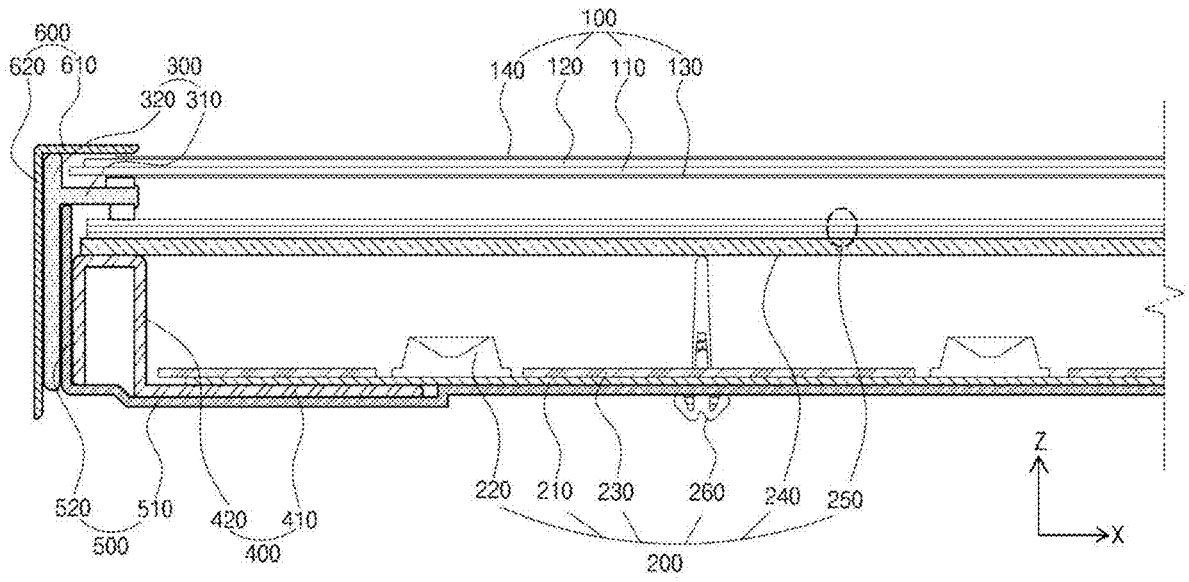


FIG. 2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620
610
300
320
310
100
140
120
110
130
520
510
500
420
410
400
220
210
230
260
240
250
200
Z
X

FIG. 3

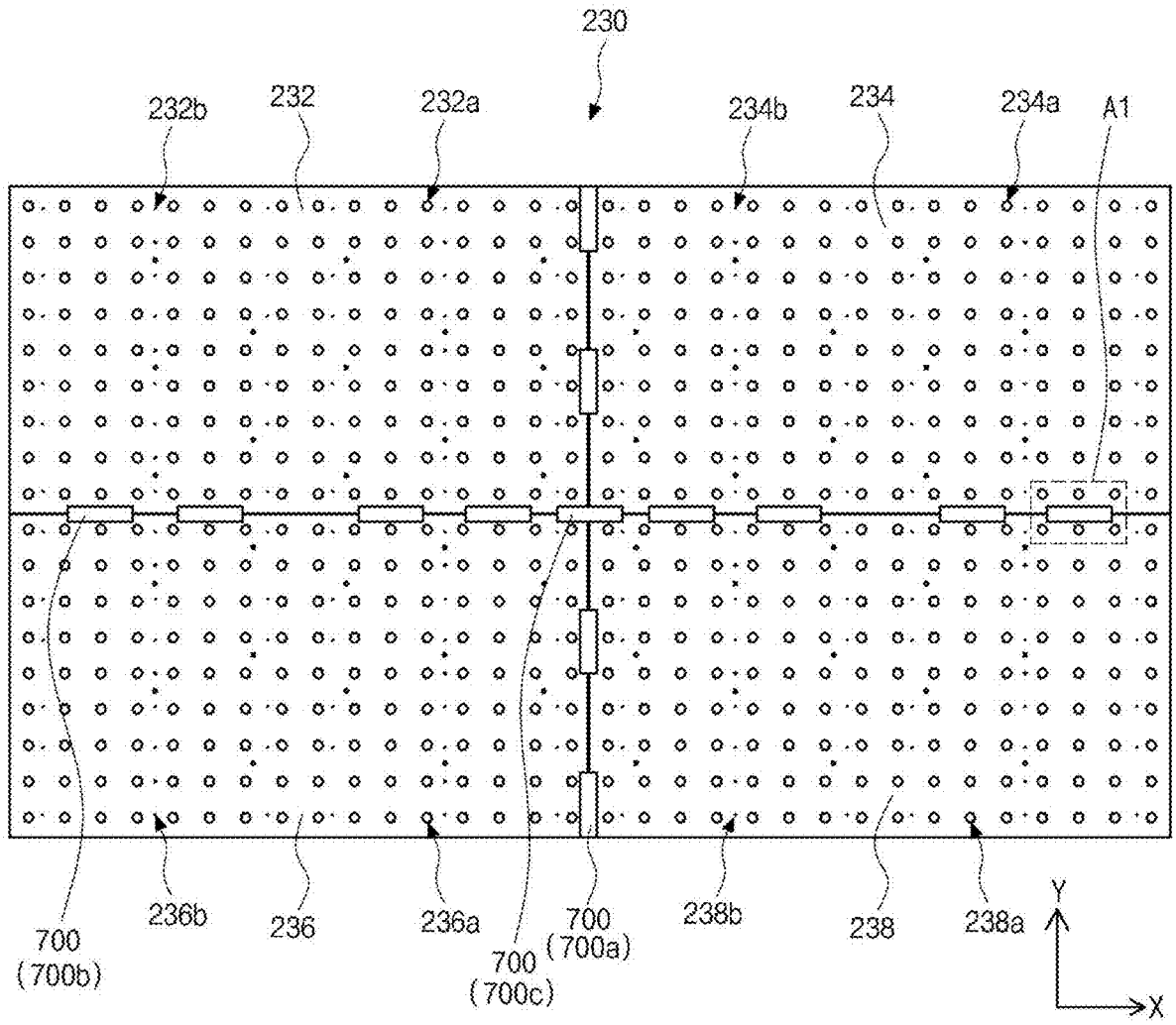

230
232b
232
232a
234b
234
234a
A1
700
(700b)
236b
236
236a
700
(700c)
700
(700a)
238b
238
238a
Y
X

FIG. 4A

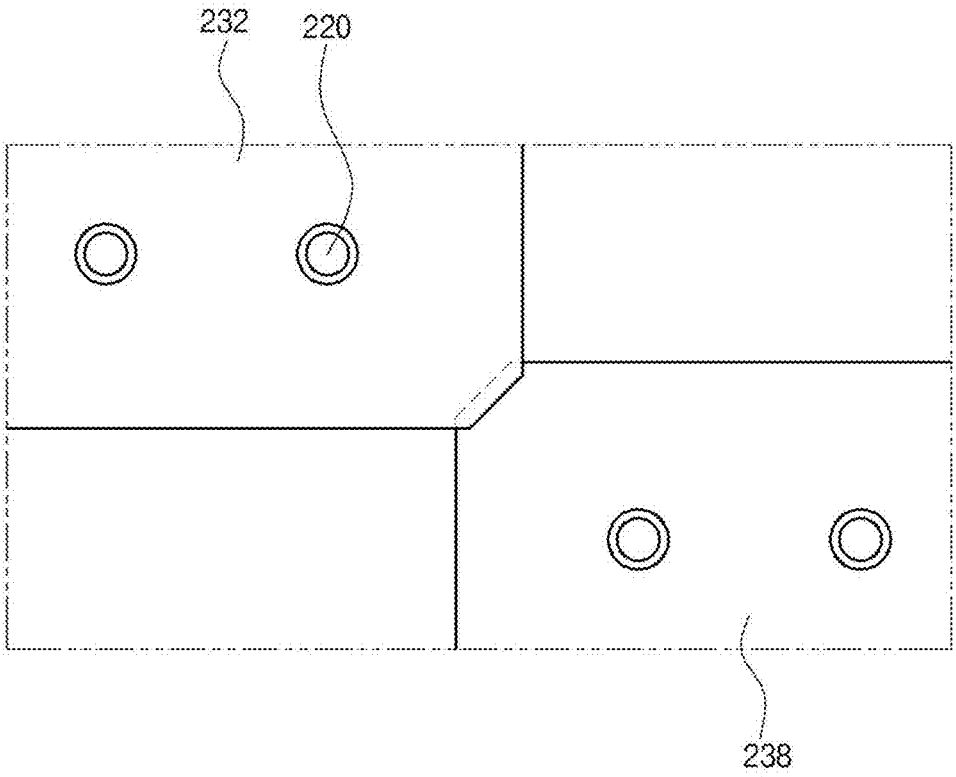


FIG. 4B

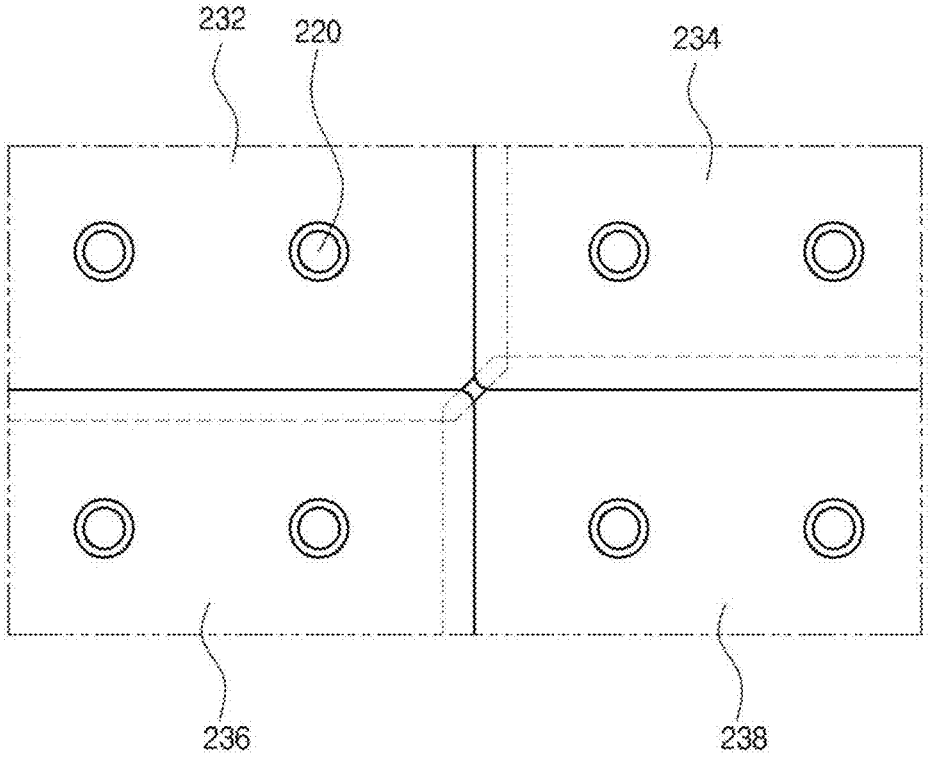


FIG. 5

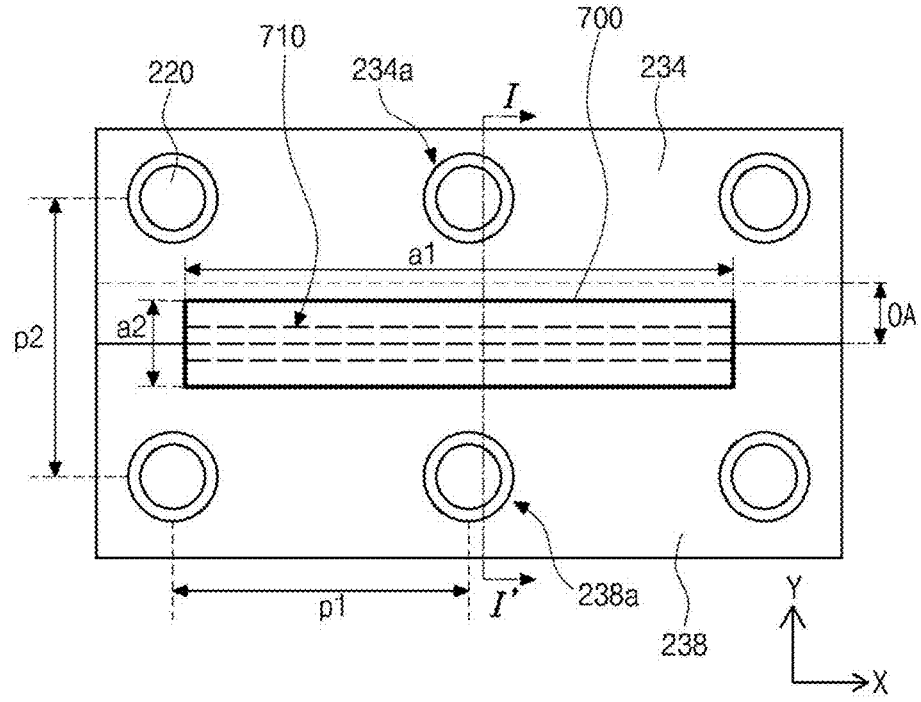

710
700
220
234a
I
234
a1
p2
a2
0A
p1
I'
238a
238
Y
X

FIG. 6A

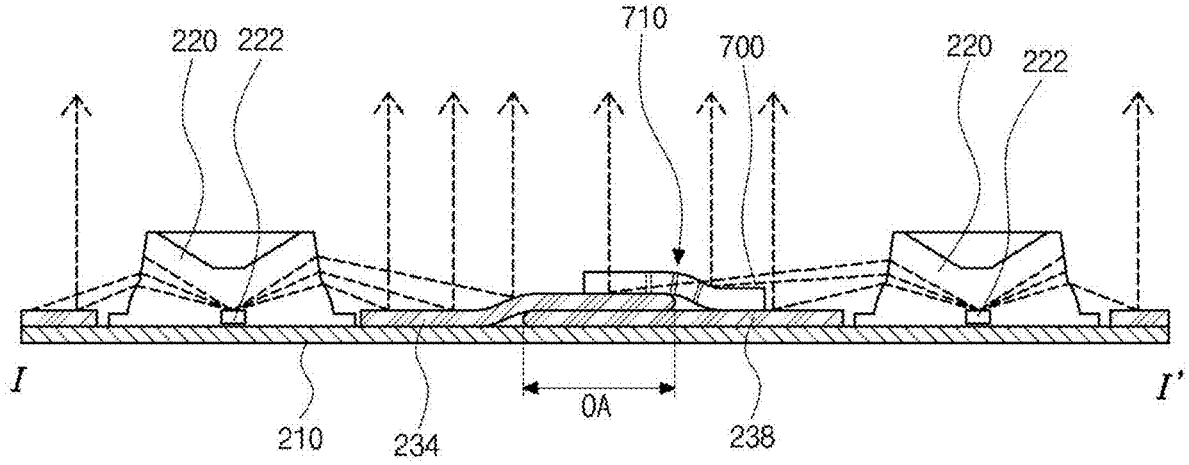

220
222
710
700
220
222
I
I'
0A
210
234
238

FIG. 6B

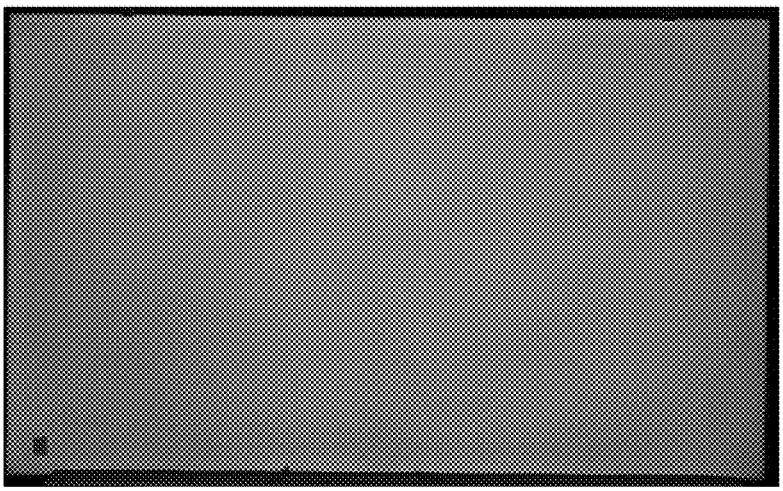


FIG. 7A

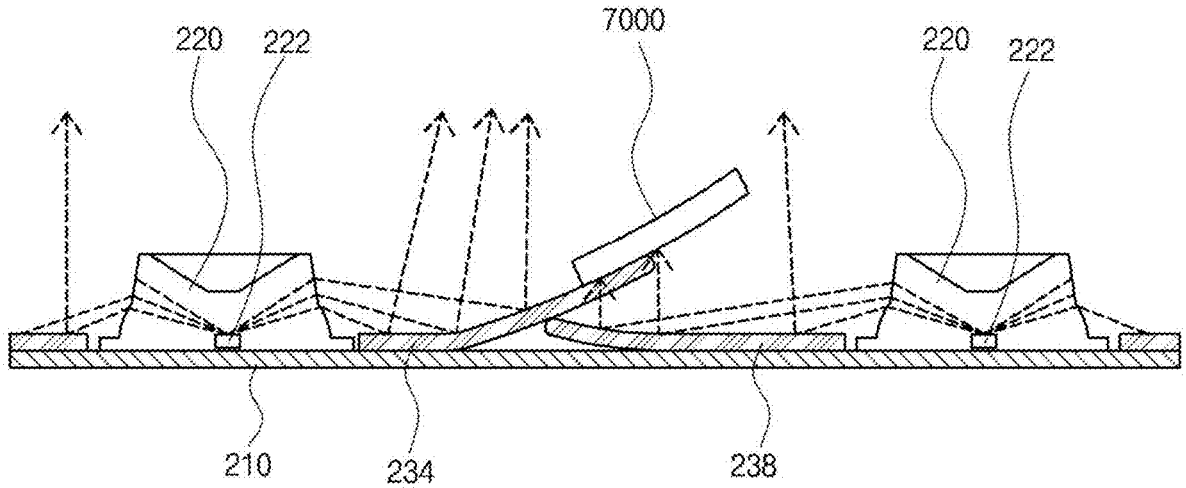


FIG. 7B

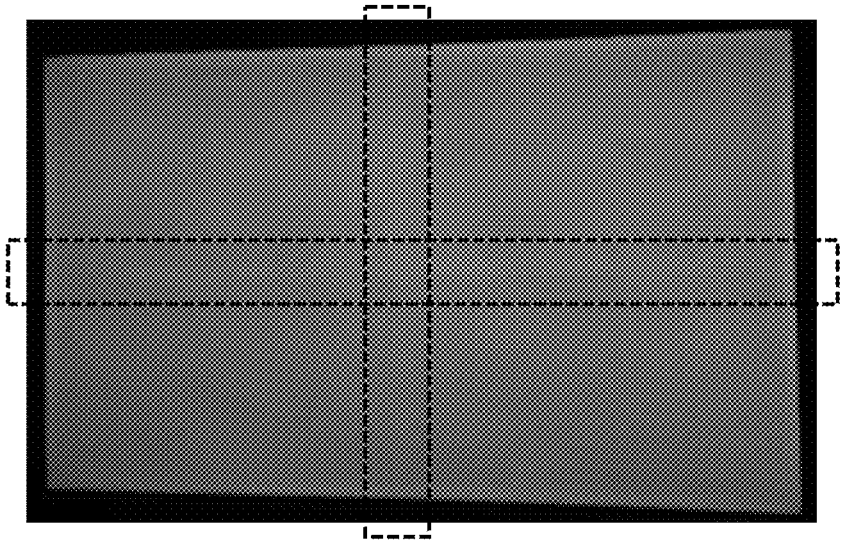


FIG. 8

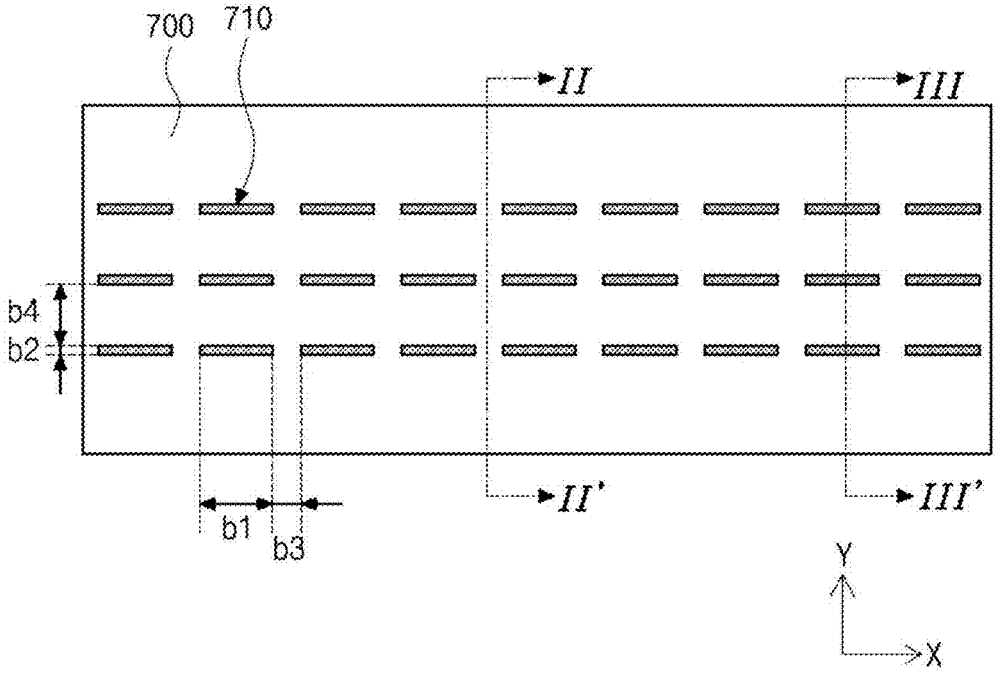


FIG. 9

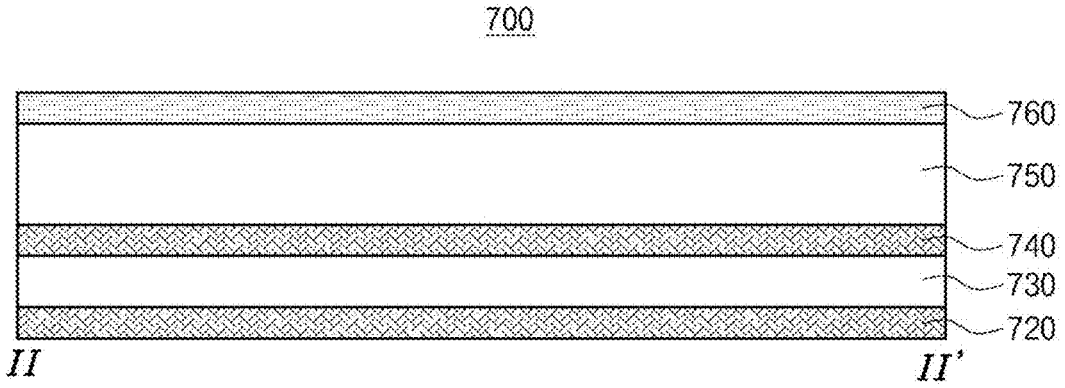

700
760
750
740
730
720
II
II'

FIG. 10

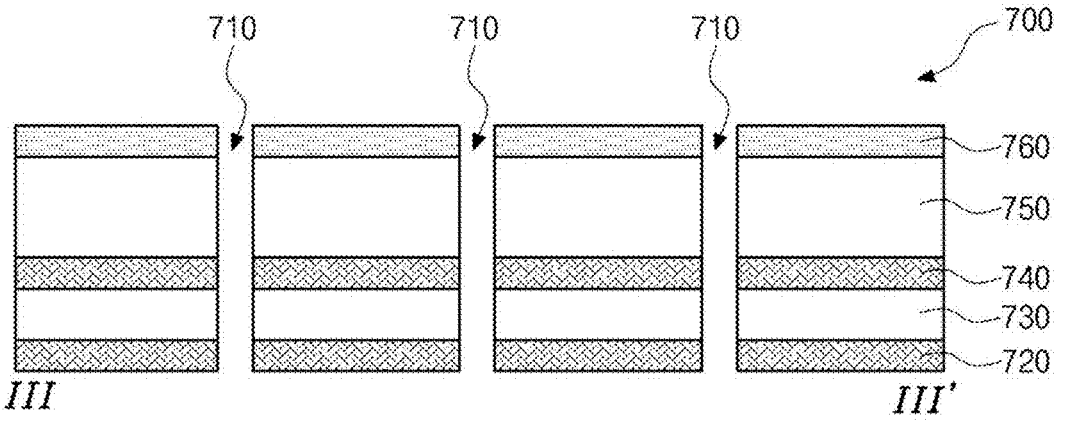

710
710
710
700
760
750
740
730
720
III
III'

FIG. 11

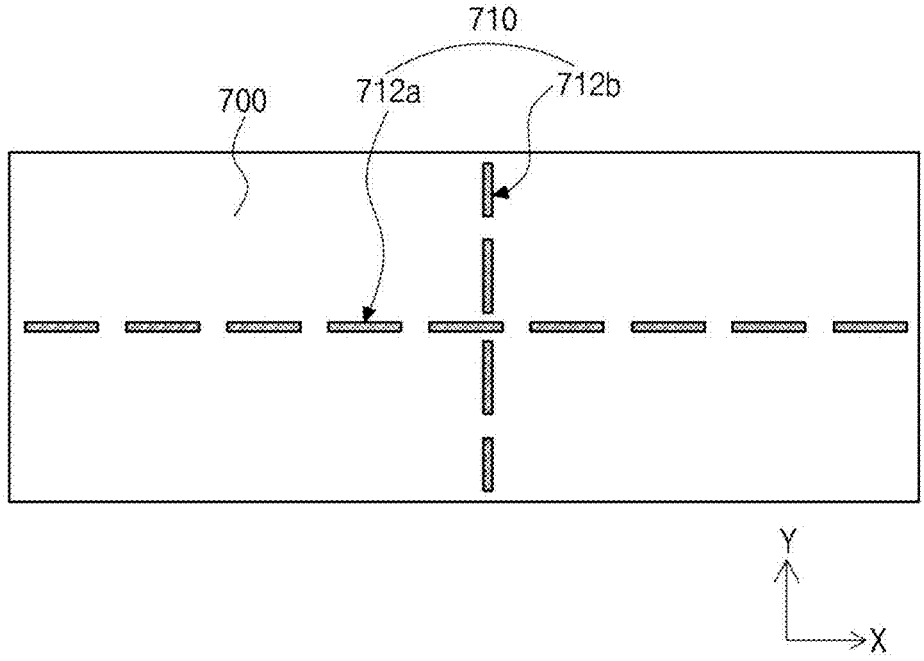


FIG. 12

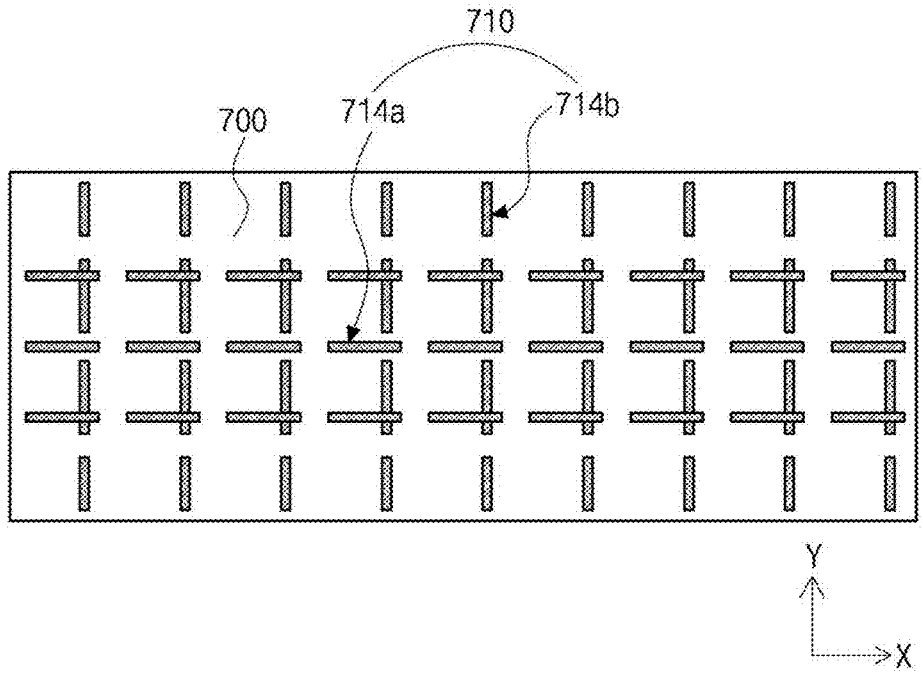
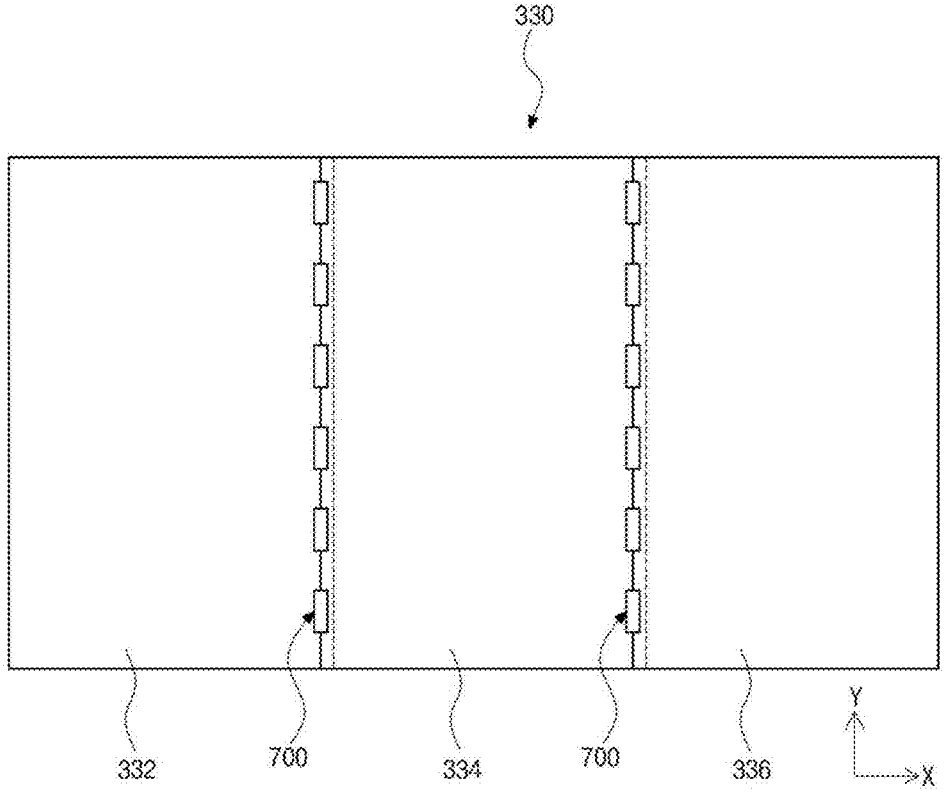


FIG. 13



LIQUID CRYSTAL DISPLAY DEVICE

CROSS-REFERENCE TO RELATED APPLICATIONS

This application is a continuation of U.S. patent application Ser. No. 18/475,449, filed on Sep. 27, 2023, which claims the priority of Korean Patent Application No. 10-2022-0158675 filed on Nov. 23, 2022, which are hereby incorporated by reference in their entirety.

BACKGROUND

Field of the Disclosure

The present disclosure relates to a display device, and more particularly, to a liquid crystal display device having a relatively large size.

Description of the Background

As the information society is in progress, a demand for display devices that display images increases in various forms, and flat panel display devices (FPD) such as liquid crystal display (LCD) devices and organic light emitting diode (OLED) display devices have been developed and applied to various fields.

Among the flat panel display devices, liquid crystal display devices have been widely used because of their compact size, light weight, thin thickness, low power driving, and the like.

The liquid crystal display devices use optical anisotropy and dielectric anisotropy of liquid crystal and include two substrates, a liquid crystal layer between the two substrates, and a pixel electrode and a common electrode for driving liquid crystal molecules of the liquid crystal layer. The liquid crystal display devices control the arrangement of the liquid crystal molecules by an electric field generated by applying a voltage to the pixel electrode and the common electrode and display images by the light transmittance changed accordingly. The liquid crystal display devices have been widely applied to portable devices such as cellphones or multimedia devices, monitors for notebooks or computers, and large televisions.

Recently, a large-sized liquid crystal display device with a larger area has been required to provide various contents and implement a realistic screen.

To provide this large-sized liquid crystal display device, the size of the components should increase, and the equipment for manufacturing each component should also increase. However, in the case of a component formed using a mold, it is difficult to produce the component as a single configuration due to the limited size of the mold. Accordingly, some components of the large-sized liquid crystal display device are manufactured by dividing, and various problems may occur in the process of joining and applying the divided portions.

In particular, when the components of the backlight unit for supplying light are divided and manufactured, it affects the luminance of the liquid crystal display device, and mura occurs at the joined part of the divided portions, resulting in uneven luminance.

SUMMARY

Accordingly, the present disclosure is directed to a liquid crystal display device that substantially obviates one or more of problems due to limitations and disadvantages described above.

More specifically, the present disclosure is to provide a liquid crystal display device having a relatively large size.

In addition, the present disclosure is to prevent mura of a large-sized liquid crystal display device.

Additional features and advantages of the disclosure will be set forth in the description which follows and in part will be apparent from the description, or may be learned by practice of the disclosure. Other advantages of the present disclosure will be realized and attained by the structure particularly pointed out in the written description and claims hereof as well as the appended drawings.

To achieve these and other advantages and in accordance with the present disclosure, as embodied and broadly described, a liquid crystal display device includes a bottom cover; a backlight unit disposed over the bottom cover and including a light source and a reflector sheet; and a liquid crystal panel disposed over the backlight unit, wherein the reflector sheet includes first and second sheet portions adjacent to each other in a first direction and at least one first reflective tape fixing the first and second sheet portions, and wherein the at least one first reflective tape includes a plurality of cutouts extending in a second direction perpendicular to the first direction.

It is to be understood that both the foregoing general description and the following detailed description are explanatory and by way of examples and are intended to provide further explanation of the disclosure as claimed without limiting its scope.

BRIEF DESCRIPTION OF THE DRAWINGS

The accompanying drawings, which are included to provide a further understanding of the disclosure and are incorporated in and constitute a part of the disclosure, illustrate aspects of the disclosure and together with the description serve to explain the principles of the disclosure.

In the drawings:

FIG. **1** is a schematic exploded perspective view of a liquid crystal display device according to an aspect of the present disclosure;

FIG. **2** is a schematic cross-sectional view of a liquid crystal display device according to an aspect of the present disclosure;

FIG. **3** is a schematic plan view of a reflector sheet of a backlight unit according to an aspect of the present disclosure;

FIGS. **4**A and **4**B are enlarged plan views schematically illustrating an arrangement of sheet portions in accordance with an assembly order of a reflector sheet of a backlight unit according to an aspect of the present disclosure;

FIG. **5** is an enlarged plan view schematically illustrating the area A**1** of FIG. **3**;

FIG. **6**A is a schematic cross-sectional view of a reflector sheet and a reflective tape according to an aspect of the present disclosure;

FIG. **6**B is a view showing reliability evaluation results of the reflector sheet and the reflective tape according to an aspect of the present disclosure;

FIG. **7**A is a schematic cross-sectional view of a reflector sheet and a reflective tape according to a comparative example;

FIG. **7**B is a view showing reliability evaluation results of the reflector sheet and the reflective tape according to a comparative example;

FIG. **8** is a plan view schematically illustrating a reflective tape according to an aspect of the present disclosure;

FIG. **9** is a cross-sectional view corresponding to line II-II' of FIG. **8**;

FIG. **10** is a cross-sectional view corresponding to line III-III' of FIG. **8**;

FIG. **11** and FIG. **12** are plan views schematically illustrating configurations of reflective tapes according to other aspects of the present disclosure; and

FIG. **13** is a plan view schematically illustrating another reflector sheet according to an aspect of the present disclosure.

DETAILED DESCRIPTION

Advantages and features of the present disclosure and methods for achieving them will be made clear from aspects described in detail below with reference to the accompanying drawings. The present disclosure may, however, be implemented in many different forms and should not be construed as being limited to the aspects set forth herein, and the aspects are provided such that this disclosure will be thorough and complete and will fully convey the scope of the present disclosure to those skilled in the art to which the present disclosure pertains.

Shapes, sizes, ratios, angles, numbers, and the like disclosed in the drawings for describing the aspects of the present disclosure are illustrative, and thus the present disclosure is not limited to the illustrated matters. The same reference numerals refer to the same components throughout this disclosure. Further, in the following description of the present disclosure, when a detailed description of a known related art is determined to unnecessarily obscure the gist of the present disclosure, the detailed description thereof will be omitted herein. When terms such as "including," "having," "consisting of," and the like mentioned in this disclosure are used, other parts may be added unless the term "only" is used herein. When a component is expressed as being singular, being plural is included unless otherwise specified.

In analyzing a component, an error range is interpreted as being included even when there is no explicit description.

In describing a positional relationship, for example, when a positional relationship of two parts is described as being "on," "above," "below," "next to," or the like, unless "immediately" or "directly" is used, one or more other parts may be located between the two parts.

Although the terms first, second, and the like are used to describe various components, these components are not substantially limited by these terms. These terms are used only to distinguish one component from another component. Therefore, a first component described below may substantially be a second component within the technical spirit of the present disclosure.

Features of various aspects of the present disclosure may be partially or entirely united or combined with each other, technically various interlocking and driving are possible, and each of the aspects may be independently implemented with respect to each other or implemented together in a related relationship.

Reference will now be made in detail to aspects of the present disclosure, examples of which are illustrated in the accompanying drawings.

FIG. **1** is a schematic exploded perspective view of a liquid crystal display device according to an aspect of the present disclosure. FIG. **2** is a schematic cross-sectional view of a liquid crystal display device according to an aspect of the present disclosure and illustrates a part of the liquid crystal display device according to an aspect of the present disclosure.

In FIG. **1** and FIG. **2**, the liquid crystal display device according to the aspect of the present disclosure may include a liquid crystal panel **100**, a backlight unit **200**, a guide panel **300**, a support main **400**, a bottom cover **500**, and a top cover **600**. The guide panel **300**, the support main **400**, the bottom cover **500**, and the top cover **600** may be joined to each other by a fastening means such as a screw.

The liquid crystal panel **100** may include a first substrate **110** at a lower position, a second substrate **120** at an upper position, and a liquid crystal layer interposed between the first and second substrates **110** and **120**.

Although not shown in the figures, the first substrate **110** may include a plurality of gate lines and a plurality of data lines on an inner surface thereof, and the gate lines and the data lines may cross each other to define a plurality of pixel regions. A thin film transistor, a pixel electrode, and a common electrode may be provided at each pixel region. The thin film transistor may be connected to the gate line and the data line, and the pixel electrode may be connected to the thin film transistor. The pixel electrode and the common electrode may generate an electric field to drive liquid crystal molecules of the liquid crystal layer. This first substrate **110** may be referred to as an array substrate.

In addition, although not shown in the figures, the second substrate **120** may include a black matrix, a color filter layer, and an overcoat layer on an inner surface thereof. The black matrix may have openings corresponding to respective pixel regions, and one of red, green, and blue color filters of the color filter layer may include may be disposed to correspond to each opening of the black matrix. This second substrate **120** may be referred to as a color filter substrate.

A first polarizer **130** may be attached to an outer surface of the first substrate **110**, that is, a lower surface of the first substrate **110**, and the second polarizer **140** may be attached to an outer surface of the second substrate **120**, that is, an upper surface of the second substrate **120** in the context of the figures. In the figures, the first polarizer **130** may be disposed under the first substrate **110**, and the second polarizer **140** may be disposed over the second substrate **120**. The first polarizer **130** and the second polarizer **140** may transmit linearly-polarized light only parallel to respective transmission axes. The transmission axis of the first polarizer **130** may be perpendicular to the transmission axis of the second polarizer **140**.

The backlight unit **200** may be disposed under the liquid crystal panel **100** to provide light to the liquid crystal panel **100**. The backlight unit **200** may include a printed circuit board (PCB) **210**, a plurality of light emitting diodes LEDs **220**, a reflector sheet **230**, a diffuser plate **240**, and an optical sheet **250**.

The backlight unit **200** may be a direct type in which the LEDs **220** of a light source is disposed right under the liquid crystal panel **100**.

Each of the LEDs **220** may be mounted on the printed circuit board **210** in the form of a package including an LED chip and a lens.

The printed circuit board **210** may supply signals to the LEDs **220**. The printed circuit board **210** may be provided in plural, and a plurality of LEDs **220** may be mounted on each printed circuit board **210**.

The reflector sheet **230** may be provided over the printed circuit board **210**. The reflector sheet **230** may have holes corresponding to the LEDs **220**, and the LEDs **220** are arranged in the respective holes. Accordingly, the reflector

sheet **230** may reflect light from the LEDs **220** toward the liquid crystal panel **100**. In addition, light reflected by the liquid crystal panel **100** or other components over the LEDs **220** and traveling toward the reflector sheet **230** may be reflected by the reflector sheet **230** again and then may be sent back to the liquid crystal panel **100**, thereby increasing the light efficiency.

Here, the reflector sheet **230** may include a plurality of sheet portions, for example, first, second, third, and fourth sheet portions **232**, **234**, **236**, and **238**, and this will be described in detail later.

The diffuser plate **240** may be disposed over the reflector sheet **230**. The diffuser plate **240** may be spaced apart from the LEDs **220** and the reflector sheet **230** with a predetermined distance and may uniformly diffuse light from the LEDs **220**.

In this case, as shown in FIG. **2**, the backlight unit **200** may further include a support member **260** to uniformly maintain a space between the LEDs **220** and the diffuser plate **240**. The support member **260** may have a lower end part penetrating the bottom cover **500** and the printed circuit board **210** and an upper end part contacting a lower surface of the diffuser plate **240**, thereby supporting the diffuser plate **240**.

The optical sheet **250** may be disposed over the diffuser plate **240**. The optical sheet **250** may include at least one diffusion sheet and at least one light-concentrating sheet such that more uniform surface light source may be incident on the liquid crystal panel **100** by diffusing or concentrating the light passing through the diffuser plate **240**.

For example, the optical sheet **250** may include two light-concentrating sheets and one diffusion sheet sequentially disposed over the diffuser plate **240**. The light-concentrating sheets may include prism patterns or lenticular patterns. In this case, one of the light-concentrating sheets may include lenticular patterns, and the other may include prism patterns.

Meanwhile, the optical sheet **250** may further include a brightness enhancement film in which layers having different refractive indexes are alternately stacked or may include the brightness enhancement film instead of the diffusion sheet.

The liquid crystal panel **100** and the backlight unit **200** may be fastened and supported by the guide panel **300**, the support main **400**, the bottom cover **500**, and the top cover **600**.

First, the liquid crystal panel **100** may be fastened on the guide panel **300**. The guide panel **300** may be formed along lateral edges of the liquid crystal panel **100**, thereby having a planar structure of a substantially square frame shape.

The guide panel **300** may include a first guide portion **310** and a second guide portion **320**. The first guide portion **310** may be a horizontal portion extending in an X direction, and the second guide portion **320** may be a vertical portion extending in a Z direction. The first guide portion **310** may extend from one side of the second guide portion **320**, and a length from a bottom end of the second guide portion **320** to the first guide portion **310** may be longer than a length from a top end of the second guide portion **320** to the first guide portion **310**.

The support main **400** may be disposed under the guide panel **300**. The support main **400** may have a planar structure of a substantially square frame shape. The support main **400** may include a first support portion **410** and a second support portion **420**.

The first support portion **410** may extend in the X direction and may be disposed between the reflector sheet **230** and the bottom cover **500**. The second support portion **420** may extend from an end of the first support portion **410** and may include at least one vertical part and at least one horizontal part. For example, the second support portion **420** may include two vertical parts and one horizontal part therebetween and may have a cross-section of a substantially U-like shape inverted up and down.

The diffuser plate **240** may be disposed on the second support portion **420**. Specifically, an edge of the lower surface of the diffuser plate **240** may be disposed on the horizontal part of the second support portion **420**. Accordingly, the diffuser plate **240** and the optical sheet **250** may be disposed between the second support portion **420** and the first guide portion **310**, and the second support portion **420** may be in contact with the lower surface of the diffuser plate **240**, thereby supporting the diffuser plate **240** and the optical sheet **250**.

The support main **400** may be made of plastic and formed through molding. For example, the support main **400** may be formed of white polycarbonate (PC). Alternatively, the support main **400** may be formed of metal and may be formed of aluminum (Al), stainless steel (SUS), or electrolytic galvanized iron (EGI), for example.

The bottom cover **500** may be provided under the support main **400**. The bottom cover **500** may include a first bottom portion **510** and the second bottom portion **520**. The first bottom portion **510** may be a horizontal plane and may extend substantially in the X direction. The first bottom portion **510** may have at least one bent part to place various components necessary for driving the liquid crystal panel **100**, for example, a driving printed circuit board and the like.

Alternatively, the support main **400** may further include an extension part disposed under the first bottom portion **510** of the bottom cover **500**, and the components such as the driving printed circuit board and the like may be disposed between the extension part of the support main **400** and the first bottom portion **510**. In this case, the second bottom portion **520** may be disposed between two vertical parts of the second support portion **420**.

The second bottom portion **520** may be a vertical plane and may extend in the Z direction. The second bottom portion **520** may be bended from an edge of the first bottom portion **510**. The second bottom portion **520** may be disposed between the guide panel **300** and the support main **400**, more particularly, between the second guide portion **320** and the second support portion **420**.

The bottom cover **500** may be formed of metal, and may be formed of aluminum (Al) or electrolytic galvanized iron (EGI), for example. However, the present disclosure is not limited thereto, and the bottom cover **500** may be formed of stainless steel (SUS).

Meanwhile, the top cover **600** may be provided over the liquid crystal panel **100**. The top cover **600** may have a planar structure of a substantially square frame shape. The top cover **600** may include a first top portion **610** and a second top portion **620**. The first top portion **610** may be a horizontal portion extending in an X direction, and the second top portion **620** may be a vertical portion extending in a Z direction. The top cover **600** may have a cross-section of a substantially L-like shape inverted up and down.

The first top portion **610** may cover edges of a front surface of the liquid crystal panel **100** and expose a central portion of the front surface of the liquid crystal panel **100**, so that an image implemented by the liquid crystal panel **100** may be displayed to the outside. The second top portion **620**

may cover outer lateral surfaces of the guide panel **300**, more particularly, outer surfaces of the second guide portion **320**.

The top cover **600** may be assembled and combined together with the guide panel **300**, the support main **400**, and the bottom cover **500**, so that the liquid crystal display device of the present disclosure may be modularized. Alternatively, the top cover **600** may be omitted.

Here, the top cover **600** may be referred to as a top frame, case top, or top case, and the bottom cover **500** may be referred to as a cover bottom or bottom frame. In addition, the guide panel **300** may be referred to as a main frame, and the support main **400** may be referred to as a main support.

The liquid crystal display device according to an aspect of the present disclosure may have a relatively large size, and for example, a diagonal length of the device may be more than 50 inches. In this case, it is difficult to manufacture the component of the backlight unit **200** as a single configuration. Specially, it is difficult to form the reflector sheet **230** as a single configuration because the reflector sheet **230** has the plurality of holes corresponding to the plurality of LEDs **220**, as described above.

Specifically, the reflector sheet **230** may be formed of plastic, for example, polyethylene terephthalate (PET). The plurality of holes may be formed by simultaneous blanking or punching. Here, when a certain number of holes, for example, 150 or more holes are formed in one sheet, it is difficult to form the reflector sheet **230** at once due to strong blanking or punching pressure.

Accordingly, the reflector sheet **230** according to an aspect of the present disclosure may be divided into the plurality of sheet portions, for example, into the first, second, third, and fourth sheet portions **232**, **234**, **236**, and **238**, and the first, second, third, and fourth sheet portions **232**, **234**, **236**, and **238** may be fixed to each other by reflective tapes **700**. This will be described with reference to FIG. **3** and FIGS. **4**A and **4**B.

FIG. **3** is a schematic plan view of a reflector sheet of a backlight unit according to an aspect of the present disclosure, and FIGS. **4**A and **4**B are enlarged plan views schematically illustrating an arrangement of sheet portions in accordance with an assembly order of a reflector sheet of a backlight unit according to an aspect of the present disclosure.

In FIG. **3** and FIGS. **4**A and **4**B, the reflector sheet **230** of the backlight unit according to an aspect of the present disclosure may include the first, second, third, and fourth sheet portions **232**, **234**, **236**, and **238**. Here, the first sheet portion **232** and the second sheet portion **234** may be arranged adjacent to each other in the X direction, and the third sheet portion **236** and the fourth sheet portion **238** may be arranged adjacent to each other in the X direction. In addition, the first sheet portion **232** and the third sheet portion **236** may be arranged adjacent to each other in the Y direction, and the second sheet portion **234** and the fourth sheet portion **238** may be arranged adjacent to each other in the Y direction. Accordingly, the first, second, fourth, and third sheet portions **232**, **234**, **238**, and **236** may be sequentially arranged in a clockwise direction.

Here, the X direction may be defined as a first direction, and the Y direction may be defined as a second direction. Alternatively, the Y direction may be defined as a first direction, and the X direction may be defined as a second direction.

Each of the first, second, third, and fourth sheet portions **232**, **234**, **236**, and **238** may include a plurality of first holes **232***a*, **234***a*, **236***a*, and **238***a* and a plurality of second holes **232***b*, **234***b*, **236***b*, and **238***b*.

The first holes **232***a*, **234***a*, **236***a*, and **238***a* may be LED holes and may correspond to the LEDs **220** of FIG. **2**, respectively. Accordingly, the LEDs **220** of FIG. **2** may be exposed through the corresponding first holes **232***a*, **234***a*, **236***a*, and **238***a*, respectively. In each of the first, second, third, and fourth sheet portions **232**, **234**, **236**, and **238**, the number of the first holes **232***a*, **234***a*, **236***a*, and **238***a* may be less than 150. For example, each of the first, second, third, and fourth sheet portions **232**, **234**, **236**, and **238** may have 144 first holes **232***a*, **234***a*, **236***a*, and **238***a*.

In addition, the second holes **232***b*, **234***b*, **236***b*, and **238***b* may be screw holes for combining with the bottom cover **500** of FIG. **2**. In each of the first, second, third, and fourth sheet portions **232**, **234**, **236**, and **238**, the number of the second holes **232***b*, **234***b*, **236***b*, and **238***b* may be smaller than the number of the first holes **232***a*, **234***a*, **236***a*, and **238***a*. However, the present disclosure is not limited thereto.

The assembly order of the first, second, third, and fourth sheet portions **232**, **234**, **236**, and **238** may be determined by considering the amount of thermal expansion of the reflector sheet **230** and/or the bottom cover **500** of FIG. **2**. As described above, the reflector sheet **230** may be formed of plastic such as polyethylene terephthalate (PET), and the bottom cover **500** of FIG. **2** may be formed of metal such as aluminum (Al) or electrolytic galvanized iron (EGI). The amount of thermal expansion of the reflector sheet **230** may vary depending on the material of the bottom cover **500** of FIG. **2**.

Therefore, the first, second, third, and fourth sheet portions **232**, **234**, **236**, and **238** may be assembled in consideration of the amount of thermal expansion of the reflector sheet **230** and/or the bottom cover **500** of FIG. **2**, so that problems may not be caused even if the reflector sheet **230** contracts or expands due to temperature changes.

Here, when the reflector sheet **230** is combined with the bottom cover **500** of FIG. **2**, the first and fourth sheet portions **232** and **238** may be fixed, while the second and third sheet portions **234** and **236** may be movable.

According to this, it is desirable that the first and fourth sheet portions **232** and **238** to be fixed may be first assembled as shown in FIG. **4**A and then the second and third sheet portions **234** and **236** to be movable may be assembled as shown in FIG. **4**B. Here, the assembly order of the first and fourth sheet portions **232** and **238** and the assembly order of the second and third sheet portions **234** and **236** may not be limited.

For example, the fourth, first, third, and second sheet portions **238**, **232**, **236**, and **234** may be sequentially combined to each other. Alternatively, the first, fourth, second, and third sheet portions **232**, **238**, **234**, and **236** may be sequentially combined to each other.

To allow the first and fourth sheet portions **232** and **238** fixed and allow the second and third sheet portions **234** and **236** movable when the reflector sheet **230** is combined with the bottom cover **500** of FIG. **2**, the second holes **234***b* and **236***b* provided in the second and third sheet portions **234** and **236** may are larger than the second holes **232***b* and **238***b* provided in the first and fourth sheet portions **232** and **238**.

Meanwhile, each of the first, second, third, and fourth sheet portions **232**, **234**, **236**, and **238** may further include third holes corresponding to a plurality of support members **260** of FIG. **2**, respectively.

The adjacent first, second, third, and fourth sheet portions **232**, **234**, **236**, and **238** may overlap with each other and may be fixed by a plurality of reflective tapes **700**.

For example, in the case of the reflector sheet **230** having a diagonal length of 98 inches, a total of thirteen reflective tapes **700** may be used. Specifically, two reflective tapes **700** may be used between the first and second sheet portions **232** and **234** adjacent to each other in the X direction, and two reflective tapes **700** may be used between the third and fourth sheet portions **236** and **238** adjacent to each other in the X direction. Four reflective tapes **700** may be used between the first and third sheet portions **232** and **236** adjacent to each other in the Y direction, and four reflective tapes **700** may be used between the second and fourth sheet portions **234** and **238** adjacent to each other in the Y direction. One reflective tape **700** may be used at a central area where the first, second, third, and fourth sheet portions **232**, **234**, **236**, and **238** are adjacent to each other. However, the present disclosure is not limited thereto, and the number of the reflective tapes **700** may vary.

Each of the plurality of reflective tapes **700** may have at least one cutout, and the cutout may extend in a length direction of the reflective tape **700**. Accordingly, first reflective tapes **700***a* between the first and second sheet portions **232** and **234** or between the third and fourth sheet portions **236** and **238** adjacent to each other in the X direction may have a cutout extending in the Y direction, and second reflective tapes **700***b* between the first and third sheet portions **232** and **236** or between the second and fourth sheet portions **234** and **238** adjacent to each other in the Y direction may have a cutout extending in the X direction. In addition, a third reflective tape **700***c* at the central area where the first, second, third, and fourth sheet portions **232**, **234**, **236**, and **238** are adjacent to each other may have a cutout extending in the X direction and may further have a cutout extending in the Y direction.

The configurations of the reflector sheet **230** and the reflective tape **700** according to an aspect of the present disclosure will be described with reference to FIG. **5**.

FIG. **5** is an enlarged plan view schematically illustrating the area A**1** of FIG. **3** and shows the LEDs together.

In FIG. **5**, the second sheet portion **234** and the fourth sheet portion **238** may be arranged adjacent to each other in the Y direction. Each of the second sheet portion **234** and the fourth sheet portion **238** may have the plurality of first holes **234***a* and **238***a*, and the plurality of LEDs **220** may be disposed in the plurality of first holes **234***a* and **238***a*, respectively.

The plurality of LEDs **220** may be arranged at regular intervals and may be spaced apart from each other with a first pitch p**1** and a second pitch p**2** in the X direction and the Y direction, respectively. For example, each of the first and second pitches p**1** and p**2** may be 50 mm to 80 mm, beneficially 60 mm to 70 mm, more beneficially 65 mm to 70 mm, but the present disclosure is not limited thereto.

Here, the first pitch p**1** may be greater than the second pitch p**2**. Alternatively, the first pitch p**1** and the second pitch p**2** may be the same.

The second sheet portion **234** may overlap with the fourth sheet portion **238** to form an overlapping area OA. A width of the overlapping area OA may be determined in consideration of contraction and expansion of the reflector sheet **230** and may be 20 nm to 30 nm, for example. However, the present disclosure is not limited thereto.

The second sheet portion **234** and the fourth sheet portion **238** may be fixed by the reflective tape **700**. The reflective tape **700** may overlap with and contact the second sheet portion **234** and the fourth sheet portion **238**.

The reflective tape **700** may have a length a**1** of the X direction and a width a**2** of the Y direction, and the length a**1** may be greater than the width a**2**. The length a**1** of the reflective tape **700** may be greater than the first pitch p**1**, and the width a**2** may be smaller than the second pitch p**2**.

For example, the length a**1** of the reflective tape **700** may be 60 mm to 80 mm, and the width a**2** may be 20 mm to 30 mm. However, present disclosure is not limited thereto. If the length a**1** is greater than 80 mm, the reflective tape **700** may be harder than the reflector sheet **230** of FIG. **3**, so that wrinkles may be formed on the reflector sheet **230** of FIG. **3**.

That is, since a thickness of the reflective tape **700** is thicker than a thickness of the reflector sheet **230** of FIG. **3**, the reflective tape **700** may have lower flexibility than the reflector sheet **230** of FIG. **3**. For example, the thickness of the reflector sheet **230** of FIG. **3** may be 0.2 mm to 0.3 mm, and the thickness of the reflective tape **700** may be greater than 0.3 mm and smaller than or equal to 0.4 mm. However, the present disclosure is not limited thereto.

Meanwhile, the reflective tape **700** may have a plurality of cutouts **710** extending in the X direction. The plurality of cutouts **710** may be provided in three rows spaced apart in the Y direction, and each row may include two or more cutouts **710** extending and spaced apart in the X direction. However, the present disclosure is not limited thereto, and the number of cutouts **710** may vary.

The plurality of cutouts **710** may impart flexibility to the reflector tape **700**, so that the reflector tape **700** may be prevented from being detached from the second and fourth sheet portions **234** and **238** even if the reflector sheet **230** contracts or expands due to the temperature changes.

In addition, when the reflective tape **700** is attached, the cutouts **710** may be used as a guide line for an attachment location, so that the reflective tape **700** may be precisely attached to the overlapping area OA of the second and fourth sheet portions **234** and **238**. Accordingly, it is possible to prevent detachment of the reflective tape **700** due to incorrect attachment.

Therefore, separation between the adjacent second and fourth sheet portions **234** and **238** may be prevented, mura may be prevented, and uniform luminance may be realized.

FIG. **6**A is a schematic cross-sectional view of a reflector sheet and a reflective tape according to an aspect of the present disclosure and illustrates a cross-section corresponding to the line I-I' of FIG. **5**, and FIG. **6**B is a view showing reliability evaluation results of the reflector sheet and the reflective tape according to an aspect of the present disclosure. FIG. **7**A is a schematic cross-sectional view of a reflector sheet and a reflective tape according to a comparative example, and FIG. **7**B is a view showing reliability evaluation results of the reflector sheet and the reflective tape according to a comparative example.

In FIG. **6**A, the second sheet portion **234** and the fourth sheet portion **238** having the overlapping area OA may be disposed on the printed circuit board **210**, and the reflective tape **700** may overlap with and contact the second sheet portion **234** and the fourth sheet portion **238** to thereby fix the second and fourth sheet portions **234** and **238**.

Here, the reflective tape **700** may have the plurality of cutouts **710**, and some of the plurality of cutouts **710** may correspond to one end of the overlapping area OA.

The detachment of the reflective tape **700** due to the temperature changes may be prevented by the plurality of

cutouts **710**, so that light from the LED chip **222** of the LED **220** may be uniformly reflected by the second and fourth sheet portions **234** and **238**.

Accordingly, as shown in FIG. **6**B, it may be seen that mura does not occur at the joined part of the divided portions of the reflector sheet.

On the other hand, in FIG. **7**A, a reflective tape **7000** according to the comparative example does not include a cutout. In this case, as the second and fourth sheet portions **234** and **238** contract and expand due to the temperature changes, the reflective tape **7000** is detached from the fourth sheet portion **238**, and a separation occurs between the second and fourth sheet portions **234** and **238**.

Therefore, light from the LED chip **222** of the LED **220** is non-uniformly reflected by the second and fourth sheet portions **234** and **238**, and a brighter area occurs compared to other areas.

Accordingly, as shown in FIG. **7**B, it may be seen that mura occurs at the joined part of the divided portions of the reflector sheet.

The reflective tape **700** of the present disclosure will be described in detail with reference to FIGS. **8** to **10**.

FIG. **8** is a plan view schematically illustrating a reflective tape according to an aspect of the present disclosure.

In FIG. **8**, the reflective tape **700** according to the aspect of the present disclosure may have a rectangular shape with a length of the X direction and a width of the Y direction and may have a plurality of cutouts **710** extending in the X direction.

Specifically, each of the plurality of cutouts **710** may have a first length b**1** in the X direction and a second length b**2** in the Y direction. The first length b**1** is greater than the second length b**2**.

In addition, each of the plurality of cutouts **710** may be spaced apart with a first interval b**3** in the X direction and spaced apart with a second interval b**4** in the Y direction.

Here, the first length b**1** and the first interval b**3** of the plurality of cutouts **710** may have a ratio of about 3:1, so that the reflective tape **700** may have flexibility against thermal expansion.

Further, the first length b**1** and the second interval b**4** may be the same. Alternatively, the first length b**1** and the second interval b**4** may be different.

For example, the first length b**1** may be 4.5 mm to 7 mm, the second length b**2** may be 0.3 mm to 1.3 mm, the first interval b**3** may be 1.6 mm to 2.3 mm, and the second interval b**4** may be 5 mm to 6 mm. However, the present disclosure is not limited thereto, and the first and second lengths b**1** and b**2** and the first and second intervals b**3** and b**4** may vary according to the size of the reflective tape **700**.

In FIG. **8**, although it is shown that three cutouts **710** are provided in the Y direction, the present disclosure is not limited thereto.

FIG. **9** and FIG. **10** are views illustrating cross-sections of a reflective tape according to an aspect of the present disclosure. FIG. **9** is a cross-sectional view corresponding to line II-II' of FIG. **8**, and FIG. **10** is a cross-sectional view corresponding to the line III-III' of FIG. **8**.

In FIG. **9** and FIG. **10**, the reflective tape **700** may include first, second, third, fourth, and fifth layers **720**, **730**, **740**, **750**, and **760** sequentially stacked.

The first layer **720** and the third layer **740** may be first and second adhesive layers and may be formed of an acrylic or silicone material. The second layer **730** may be a base layer and maintain a structure of the reflective tape **700**. The second layer **730** may be formed of polyethylene terephthalate (PET).

The fourth layer **750** may be a reflecting layer and may be formed of stretched polyethylene terephthalate. The fifth layer **760** may be a diffusing layer and may be formed by coating a diffusion agent. TiO2, microbeads, or PET beads may be used as the diffusion agent, and a matrix material and the diffusion agent may be dispersed in a solvent and then coated.

Here, the first, second, and third layers **720**, **730**, and **740** may constitute a double-sided tape, and the fourth and fifth layers **750** and **760** may constitute a reflection unit. That is, the reflective tape **700** may include a double-sided tape **720**, **730**, and **740** and a reflection unit **750** and **760**, and the double-sided tape **720**, **730**, and **740** may be disposed between the reflection unit **750** and **760** and the reflector sheet **230** of FIG. **3**.

Accordingly, while the reflector sheet **230** of FIG. **3** may be fixed through the double-sided tape **720**, **730**, and **740**, the reflection unit **750** and **760** may be attached to the reflector sheet **230** of FIG. **3** to reflect light.

A thickness of the reflection unit **750** and **760** may be thicker than a thickness of the double-sided tape **720**, **730**, and **740**. More particularly, a thickness of the fourth layer **750**, which is a reflecting layer, may be thicker than the thickness of the double-sided tape **720**, **730**, and **740**. Accordingly, the thickness of the fourth layer **750** may be thicker than a thickness of the second layer **730**, which is a base layer.

In addition, the first and third layers **720** and **740**, which are adhesive layers, may have the same thickness, and the thickness of each of the first and third layers **720** and **740** may be smaller than the thickness of the second layer **730**.

Meanwhile, a thickness of the fifth layer **760**, which is a diffusing layer, may be smaller than the thickness of each of the first, second, third, and fourth layers **720**, **730**, **740**, and **750**. Therefore, the thickness of the fifth layer **760** may be smaller than the thickness of each of the first and third layers **720** and **740**.

For example, the thickness of each of the first and third layers **720** and **740** may be 25 μm, the thickness of the second layer **730** may be 50 μm, the thickness of the fourth layer **750** may be 225 μm, and the thickness of the fifth layer **760** may be 20 μm. However, the present disclosure is not limited thereto.

As described above, the reflective tape **700** may include the plurality of cutouts **710**, and the plurality of cutouts **710** may be formed through the first, second, third, fourth, and fifth layers **720**, **730**, **740**, **750**, and **760**.

Accordingly, when the reflective tape **700** is attached between the stepped area of the adjacent first, second, third, and fourth sheet portions **232**, **234**, **236** and **238** of the reflector sheet **230** of FIG. **3**, even if the reflector sheet **230** of FIG. **3** contracts and expands due to the temperature changes, the first, second, third, and fourth sheet portions **232**, **234**, **236**, and **238** of FIG. **3** are not separated or detached because the reflective tape **700** has fluidity.

Therefore, it is possible to prevent light leakage.

The reflective tape **700** of the present disclosure may include cutouts having different configurations according to the joined part.

FIG. **11** and FIG. **12** are plan views schematically illustrating configurations of reflective tapes according to other aspects of the present disclosure.

In FIG. **11**, the reflective tape **700** according to another aspect of the present disclosure may include a plurality of cutouts **710**. The cutouts **710** may include first cutouts **712***a* extending and spaced apart in the X direction and second cutouts **712***b* extending and spaced apart in the Y direction.

The first cutouts **712***a* may be provided as a single row and may be disposed along the center of the reflective tape **700** in the Y direction. The second cutouts **712***b* may be provided as a single row and may be disposed along the center of the reflective tape **700** in the X direction.

Alternatively, in FIG. **12**, the reflective tape **700** according to another aspect of the present disclosure may include a plurality of cutouts **710**. The cutouts **710** may include a plurality of first cutouts **714***a* extending and spaced apart in the X direction and a plurality of second cutouts **714***b* extending and spaced apart in the Y direction.

The first cutouts **714***a* and second cutouts **714***b* may be provided as a plurality of rows. For example, the first cutouts **714***a* may be provided as three rows, and the second cutouts **714***b* may be provided as nine rows. However, the present disclosure is not limited thereto.

The reflective tapes **700** of FIG. **11** and FIG. **12** may be applied to the central area of the reflector sheet **230**, that is, may be used as the third reflective tape **700***c* disposed in the area where the first, second, third, and fourth sheet portions **232**, **234**, **236**, and **238** are adjacent to each other.

FIG. **13** is a plan view schematically illustrating another reflector sheet according to an aspect of the present disclosure. Here, the reflector sheet may be divided into three portions.

In FIG. **13**, another reflector sheet **330** according to an aspect of the present disclosure may include first, second, and third sheet portions **332**, **334**, and **336**. Here, the first sheet portion **332** and the second sheet portion **334** may be arranged adjacent to each other in the X direction, and the second sheet portion **334** and the third sheet portion **336** may be arranged adjacent to each other in the X direction. Therefore, the second sheet portion **334** may be disposed between the first and third sheet portions **332** and **336**.

Although not shown in the figure, each of the first, second, and third sheet portions **332**, **334**, and **336** may include a plurality of first holes as an LED hole and a plurality of second holes as a screw hole.

Here, adjacent ones of the first, second, and third sheet portions **332**, **334**, and **336** may overlap with each other. The second sheet portion **334** may be disposed over the first sheet portion **332**, and the third sheet portion **336** may be disposed over the second sheet portion **334**.

The adjacent first, second, and third sheet portions **332**, **334**, and **336** may be fixed by a plurality of reflective tapes **700**. In this case, each of the plurality of reflective tapes **700** may have a plurality of cutouts extending in the Y direction.

Each of the reflective tapes **700** may have the configuration corresponding to those shown in FIGS. **8** to **12**.

In the above aspects, although the configuration in which the reflector sheet is divided into three or four sheet portions has been described, the number of the divided portions of the reflector sheet of the present disclosure is not limited thereto and may be applied in various ways.

In the present disclosure, by dividing the reflector sheet, it is possible to provide a backlight unit having a relatively large size and a liquid crystal display device including the same.

In addition, by fixing the divided reflector sheet using a reflective tape with cutouts, the reflective tape may have fluidity. Thus, when the reflector tape contracts and expands due to the temperature changes, separation between the adjacent second and fourth sheet portions **234** and **238** may be prevented, and mura may be prevented.

Further, when the reflective tape is attached, the reflective tape may be precisely attached to the divided reflector sheet using the cutouts, so that it is possible to facilitate work and prevent detachment of the reflective tape **700** due to incorrect attachment.

It will be apparent to those skilled in the art that various modifications and variations may be made in the display device of the present disclosure without departing from the technical idea or scope of the disclosure. Thus, it is intended that aspects of the present disclosure cover the modifications and variations of the disclosure provided they come within the scope of the appended claims and their equivalents.

What is claimed is:

1. A display device, comprising:
- a bottom cover; and
- a light unit disposed over the bottom cover and including a light source and a reflector sheet,
- wherein the reflector sheet includes first and second sheet portions adjacent to each other in a first direction, and the first and second sheet portions overlap each other and are fixed with at least one first reflective tape, and
- wherein the at least one first reflective tape includes a plurality of cutouts.

2. The display device of claim **1**, wherein the light source includes at least a light emitting diode (LED).

3. The display device of claim **1**, wherein the plurality of cutouts extend in a second direction perpendicular to the first direction.

4. The display device of claim **3**, wherein each of the plurality of cutouts has a first length of the second direction and a second length of the first direction, and
- wherein the first length is greater than the second length.

5. The display device of claim **4**, wherein the plurality of cutouts are spaced apart with a first interval in the second direction, and
- wherein the first length is greater than the first interval.

6. The display device of claim **5**, wherein the plurality of cutouts are spaced apart with a second interval in the first direction, and
- wherein the second length is smaller than the second interval.

7. The display device of claim **1**, wherein the plurality of cutouts are provided in a plurality of rows spaced apart in the first direction, and
- wherein each row comprises two or more cutouts extending and spaced apart.

8. The display device of claim **1**, wherein the at least one first reflective tape includes a double-sided tape and a reflection unit, and
- wherein the double-sided tape is disposed between the reflection unit and the reflector sheet.

9. The display device of claim **8**, wherein the reflection unit includes a reflecting layer, and a thickness of the reflecting layer is greater than a thickness of the double-sided tape.

10. The display device of claim **9**, wherein the reflection unit further includes a diffusing layer, and
- wherein the reflection unit is disposed between the double-sided tape and the diffusing layer.

11. The display device of claim **1**, further comprising:
- a liquid crystal panel disposed over the light unit;
- a printed circuit board disposed on which the light source is mounted;
- a diffuser plate disposed over the reflector sheet; and
- an optical sheet disposed over the diffuser plate.

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